COOLANT TRANSFER MACHINE FOR AUTOMOTIVE VEHICLE & METHOD

RELATED PATENT APPLICATIONS & INCORPORATION BY REFERENCE

This application is a continuation application of utility patent application Serial No. 10/140,047, entitled "Coolant Transfer Machine For Automotive Vehicle & Method," filed May 7, 2002, which is based on U. S. provisional patent application Serial No. 60/289,483, entitled "Coolant Transfer Machine For Automotive Vehicle & Method," filed May 8, 2001. If any conflict arises between the disclosure of the invention in this application and that in the related provisional application, the disclosure in this utility application shall govern. Moreover, the inventors incorporate herein by reference any and all U. S. patents, U. S. patent applications, and other documents cited or referred to in this application or cited or referred to in the U. S. patents and U. S. patent applications incorporated herein by reference.

DEFINITIONS

The words “comprising,” “having,” "containing," and “including,” and other forms thereof, are intended to be equivalent in meaning and be open ended in that an item or items following any one of these words is not meant to be an exhaustive listing of such item or items, or meant to be limited to only the listed item or items.

BACKGROUND OF THE INVENTION

Servicing of automotive vehicles typically requires periodic

replacement of the coolant in the cooling system for the vehicle's engine. Fluid transfer machines such as, for example, illustrated in U. S. Patent Nos. 4,782,689; 4,888,980; 5,573,045; 5,615,716; 6,135,136; 6,152,193; 6,161,566; and 6,213,175B1, are sometimes used to transfer the used coolant to a storage vessel while replacing this used coolant with new coolant. Many coolant transfer machines employ a system relying on the vehicle's engine to provide the power to effect the coolant transfer. In some instances this limits the speed at which the transfer can be accomplished. Other coolant transfer machines shut the engine off and employ a different system relying on external means for providing the power to transfer coolant.

SUMMARY OF THE INVENTION

This invention has several features. Without limiting the scope of this invention as expressed by the claims that follow, its more prominent features will now be discussed briefly. After considering this discussion, and particularly after reading the section entitled, "DETAILED DESCRIPTION," one will understand how the features of this invention provide its benefits, which include, but are not limited to, rapid transfer of coolant, a hybrid system that allows the user to select between two different systems the one best suited for the vehicle being serviced, avoiding creating "hot spots" in the engine's cooling system, and economies in that the hybrid system is contained within a single housing and shares common components.

In accordance with this invention, coolant is transferred to and from an automotive engine having a radiator in communication with the engine using a machine that carries a new fluid container that holds new coolant and a used fluid container that holds used coolant

from the engine. The first feature of the coolant transfer machine of this invention is that it includes two fluid transfer systems: A first fluid transfer system that sequentially first removes at least a substantial portion of used coolant from the engine and collects in the used fluid container the used coolant as the used coolant is being removed and then replaces the removed used coolant with new coolant from the new fluid container. And a second fluid transfer system that simultaneously displaces at least a substantial portion of used coolant in the engine with new coolant from the new fluid container and collects the displaced used coolant in the used fluid container. The engine is not operational while the first fluid transfer system is transferring coolant and the engine is operational while the second fluid transfer system is transferring coolant. A manually operable switch is used to select the fluid transfer system to be used based on the type of service to be provided: Namely, a quick service where the first fluid transfer system is typically used, or more complete service that requires more time where the second fluid transfer system is typically used, or a service that depends on the type of individual engine being serviced, where either the first or second fluid transfer system may be usedOptionally, the second fluid transfer system includes a closed loop circuit that recycles fluid between the radiator and engine rather than transferring used fluid from the engine to the used fluid container and new fluid from the new fluid container to the radiator. The containers each include a sensor. The sensor in the new fluid container initiates the closed loop circuit when the sensor detects that the new fluid container is empty or near empty. The sensor in the used fluid container initiates the closed loop circuit when the sensor detects that the used fluid container is full or near full.

The second feature of this invention is that the first fluid transfer

system includes a first adapter that is first manually inserted into an opening in the radiator upon removal of a radiator cap covering this opening. This first adapter may be in the form of a plug that is inserted into the opening. The adapter is then manually connected to the used fluid container to establish communication between the radiator and the used fluid container to transfer the used coolant from the engine to the used fluid container via the radiator. After withdrawing used coolant from the radiator, the first adapter is manually connected to the new fluid container to establish communication between the radiator and the new fluid container to transfer new coolant to the engine via the radiator. In an alternate embodiment of the first fluid transfer system, the engine is placed in communication with the containers via a connector attached to a radiator over flow member. A first pump is manually placed in communication with the used fluid container and the radiator to pump the used coolant from the engine through the radiator and into the used fluid container to create a reduced pressure in the engine. Upon establishing communication between the new fluid container and the radiator, the reduced pressure in the engine sucks new fluid into the radiator to replace the removed used coolant with new coolant.

The third feature of this invention is that the second fluid transfer system includes a pair of adapters. The coolant in the engine flows from the engine into the radiator through a manual detachable member such as, for example, a rubber tube. Upon manually detaching the detachable member, the pair of adapters is attached to provide access of coolant to the radiator and the engine. One adapter establishes communication with the new fluid container to transfer new coolant to the engine via the radiator. The other adapter establishes communication with the used fluid container to collect used coolant

being displaced by the new coolant from the new fluid container.

The fourth feature of this invention is the use of hoses to establish communication between the containers and the engine through the adapters or the connector attached to the radiator over flow member. A drain hose is placed in communication with the used fluid container to transfer the used coolant from the engine to the used fluid container. And a supply hose is placed in communication with the new fluid container to transfer new coolant to the engine after transfer of the substantial portion of the used coolant from the engine. The hoses are manually connected and disconnected to individual adapters or the connector attached to a radiator over flow member depending on which fluid transfer system is being used. These hoses, adapters, and connector attached to the radiator over flow member employ conventional quick connect-disconnect connectors. These conventional quick connect-disconnect connectors each have one coupling component attached to a hose and another coupling component attached to an adapter or the connector for the radiator over flow member. These coupling components interact very quickly and have interlocking elements that, when the coupling components are connected or disconnected, maintain substantially the reduced pressure in the engine, preventing air at atmospheric pressure from entering the radiator, engine or either fluid transfer system.

The fifth feature of this invention is that the machine has a housing with a control panel and a base that supports the new fluid container and the used fluid container. The containers are free-standing and capable of being individually removed from the base and replaced. The first and second fluid transfer systems are within this housing and the drain hose, supply hose, the first pump, and a second pump along the supply hose are common components of both systems.

The first pump is operated only when the first fluid transfer system is operational and second pump is operated only when the second fluid transfer system is operational.

The sixth feature of this invention is that the first and second fluid transfer systems have a common waste removal system operable when said first and second fluid transfer systems are disconnected from the engine. This common waste removal system transfers to a waste storage container used coolant in the used fluid container.

This invention also includes a method of transferring coolant to and from an automotive engine having an engine cooling system including a radiator. This method includes the steps of:

(a) providing a new fluid container holding new coolant and a used fluid container for holding used coolant from the engine,

(b) providing a first fluid transfer system that sequentially first removes at least a substantial portion of used coolant from the engine and collects in a used fluid container the used coolant as said used coolant is being removed and then replaces said removed used coolant with new coolant from a new fluid container, said engine being non-operational when coolant is being transferred,

(c) providing a second fluid transfer system that simultaneously displaces at least a substantial portion of used coolant in the engine with new coolant from the new fluid container and collects the displaced used coolant in the used fluid container, said engine being operational when coolant is being transferred, and

(d) selecting one of said fluid transfer systems to transfer coolant based on the type of service to be provided.

DESCRIPTION OF THE DRAWING

The preferred embodiments of this invention, illustrating all its features, will now be discussed in detail. These embodiments depict the novel and non-obvious coolant transfer machine, systems and method of this invention as shown in the accompanying drawing, which is for illustrative purposes only. This drawing includes the following figures (Figs.), with like numerals indicating like parts:

Fig. 1 is a schematic diagram of the hybrid coolant transfer machine of this invention showing the vehicle's engine off and the first fluid transfer system in the evacuation mode wherein used coolant is transferred from the engine's cooling system to a used fluid container (Used Fluid Tank T1).

Fig. 2 is a schematic diagram of the hybrid coolant transfer machine shown in Fig. 1 and the first fluid transfer system in the fill mode wherein new coolant is transferred to the engine's cooling system from a new fluid container (New Fluid Tank T2).

Fig. 2A is a schematic diagram of an alternate embodiment of the hybrid coolant transfer machine of this invention showing the vehicle's engine off and the first fluid system in the evacuation mode wherein used coolant is transferred from the engine's cooling system to a used fluid container via a radiator over flow tube.

Fig. 3 is a schematic diagram of the hybrid coolant transfer machine of this invention showing the vehicle's engine on and the second fluid transfer system operational wherein used coolant is displaced from the engine's cooling system and transferred a used fluid container as new coolant is pumped into the engine's cooling system from the new fluid container.

Fig. 4 is a schematic diagram of the hybrid coolant transfer machine shown in Fig. 3 with the vehicle's engine on and the second fluid system operational and in a loop mode.

Fig. 5 is a schematic diagram of the hybrid coolant transfer machine shown in Figs. 1 and 3 with the vehicle's engine disconnected from the machine and used coolant in the used fluid container being transferred to a waste storage container.

Fig. 6 is a perspective view of the hybrid coolant transfer machine of this invention showing the machine's housing which includes the first and second fluid transfer systems depicted in Figs. 1 and 3.

Fig. 7 is an enlarged, fragmentary view of the control panel displayed on the outside of the cover of the housing shown in Fig. 6.

Fig. 8 is a perspective view of the side of the housing shown in Fig. 6.

Fig. 9 is a rear view of the housing shown in Fig. 6.

Fig. 10 is a plan view of an internal wall of the housing cover showing the backside of the control panel.

Fig. 11 is a plan view of the exterior top of the housing platform showing various components of the hybrid coolant transfer machine of this invention.

Fig. 12 is a schematic wiring diagram of the control circuit for the hybrid coolant transfer machine of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As illustrated in Figs. 1 through 5, the hybrid coolant transfer machine 10 of this invention employs two fluid transfer systems, the Evac system A (Figs. 1, 2 and 2A) adapted to be operated when the

vehicle's engine 12 is not operating and the Flush system B adapted to be operated when the vehicle's engine is operating (Figs. 3 and 4). The components of both fluid transfer systems A and B are mounted to, or contained within, a housing 14 shown in Figs. 6, 8 and 9. The housing 14 includes a cover 14a with hinges 14b, rectangular base 14c, and, centrally positioned on the base, a pedestal (not shown) that extends upward in a vertical orientation to provide a partition. As best shown in Fig. 2, fixedly attached to the top of the pedestal 14 is a flat, rectangular, planar platform P oriented horizontally. This platform P is used to support components of the fluid transfer machine 10. The structural features of the housing 14 are discussed in detail in U. S. provisional patent application Serial No. 60/266,399, filed February 2, 2001, and U. S. utility patent application Serial No. 10/059,868, filed January 29, 2002, based on the provisional patent application Serial No. 60/266,399, both assigned to MOC Products Company, Inc., the assignee of this utility patent application.

In accordance with this invention, both the systems A and B include the following common components: Used Fluid Tank T1, New Fluid Tank T2, solenoid actuated Valve #1, solenoid actuated Valve #2, a 30 Micron Filter F1, 12 Volt Pump P1, Check Valve C1, Flow Indicator F2, Pressure Gage G1, Drain Hose H1, Supply Hose H2, and a control panel 100 (Fig. 7) displayed on the upper, front exterior of the cover 14a of the housing 14. As best shown in Fig. 7, the control panel 100 includes a flow indicator display 102, a system pressure gauge display 104 (the system pressure gauge G1 is downstream of the flow indicator F1), a main switch 20 with its control knob 20a on the panel 100, a service complete indicator light L1, a used fluid tank full light L2, top off pump control button B1, and a mechanical toggle switch 106 for actuating an Air Pump P2. (An electrical pump may be used in place of

the Air Pump P2 and an electrical switch used in place of the toggle switch 106 to operate a relay for actuating the electrical pump.) The hoses 108 shown in Figs. 6, 10 and 11 are internal plumbing hoses connecting the components of the systems A and B together as depicted schematically in Figs. 1 through 5. The system A also includes a solenoid actuated Air Valve #4, and a Radiator Hose Adapter or plug 26. The system B also includes a solenoid actuated Valve #3, and a pair of adapters 16 and 18 that are disclosed in detail in U. S. utility patent application Serial No. 09/850,831, filed in the names of Michael J. Camacho and Carl Brod on May 8, 2001, and entitled "Adapter For A Coolant Transfer Machine, Methods Of Transferring Coolant & Kit," and assigned to MOC Products Company, Inc., the assignee of this utility patent application.

As depicted in Fig. 1, when using the system A, the engine 12 is shut off so that it is non-operational and the knob 20a of the main switch 20 on the control panel 100 (Fig. 7) is turned manually to the position "Evac Service" to energize the solenoid controlled Air Valve #4 to place the Air Pump P2 through the Valve #4 in communication with a source of air under pressure (Shop Air) to provide air to actuate the Air Pump. As shown in Fig. 9, there is a port 110 that enables an air line 22 from the source of air (Shop Air) to be connected to the machine 10. There are also jumper cables 112 attached to the rear exterior wall of housing 14 to allow the machine's control circuit 114 (Fig. 12) to be connected to the battery B1 of the vehicle being serviced.

The plug 26 and the Drain Hose H1 are connected by a conventional two component quick connect-disconnect coupling 24. A suitable two component quick connect-disconnect coupling 24 may be obtained form, Rectus GMBH, a German company, dba Oboc with office

in Sparta, New Jersey. The terminal end of the Drain Hose H1 has one component 24a and the plug 26 has extending from it the other component 24b. The Supply Hose H2 has a component 24c connected to its terminal end for connecting the Supply Hose H2 as illustrated in Fig. 2. The plug 26 is inserted into a top opening 25a in the radiator 25 that is normally closed by a radiator cap 28a (Fig. 2A). When using system A, the radiator cap 28a is removed to uncover this opening 25a prior to insertion of the plug 26. In an alternate embodiment shown in Fig. 2A, the radiator cap 28a is not removed and the Drain Hose H1 is connected to a Radiator Over Flow Tube 116 via a detachable member 30 having at its terminal end the component 24b for connection to the component 24a.

With the knob 20a of the main switch 20 on the control panel 100 (Fig. 7) turned to the "Evac Service" position, Relays R1, R2, R3, and R4 in the control circuit 114 are energized so that the Valves #1, #2, #3 and #4 are in position shown in Fig. 1 to enable used coolant to flow from the engine cooling system, the radiator 24, hoses 27 and 28, the engine's water pump 29, and the engine's internal cooling passageways (not shown) via the plug 26, the Drain Hose H1, and Valves #1 and #2 into the Used Fluid Tank T1. The Valves #1, #2, and #3, are located within the housing 14 as shown in Fig. 11 on the flat, rectangular, planar, horizontal platform P of the housing. The cover 14a is attached to the platform P by hinges 14b. This platform P is also used to support the Air Pump P2, 12 Volt Pump P1, a Filter Housing 120 for the 30 Micron Filter F1, and at least some of the components of the control circuit, for example, the relays R1, R2, R3, and R4. As shown in Fig. 11, these components may be accessed by raising the housing cover 14a.

The open Valve #4 allows air under pressure to flow through the

air line 22 to the Air Pump P2 which pumps the used coolant from the engine cooling system into the Used Fluid Tank T1. This reduces the pressure within the engine's cooling system. Depending on the type of vehicle being serviced from about 20 to about 80, or even greater, volume percent of the coolant in the engine cooling system is transferred into the Used Fluid Tank T1. The technician may access the engine's cooling system prior to adding new coolant, for example, to replace a thermostat. If this was done, the engine's cooling system would be at atmospheric pressure. In such a case, after accessing the engine's cooling system to replace the thermostat, the technician would again reconnect (if disconnected) the Drain Hose H1 as shown in Fig. 1 and turn the main switch 20 to the Evac Service position to again remove some more used coolant and reduce the pressure in the engine's cooling system. The Drain Hose H1 is now disconnected and the Supply Hose H2 connected as shown in Fig. 2.

As illustrated in Fig. 2, upon completion of removal of used coolant from the engine cooling system, the knob 20b of the main switch 20 is turned to its OFF position and the Drain Hose H1 is disconnected from the plug 26 by detaching the coupling component 24a from the coupling component 24b and the coupling component 24c on the end of the Supply Hose H2 is attached to the coupling component 24b. The quick connect-disconnect couplings components 24a and 24b and 24c all close immediately upon being disconnected. Consequently, the use of a two component quick connect-disconnect coupling 24 avoids introducing air into the cooling system upon disconnecting the Drain Hose H1 and connecting the Supply Hose H2, and the reduced pressure is maintained within the engine's cooling system.

The new (unused) coolant is fed from the New Fluid Tank T2 via

the Supply Hose H2 through the 30 Micron Filter F1, the 12 Volt Pump P1, the Check Valve C1, the Flow Indicator F2, a passageway 26a (shown in dotted lines) in the plug 26 into the radiator 25 though the radiator opening 25a. Because of the reduced pressure within the engine's cooling system, the new coolant is simply sucked into the engine's cooling system. The new coolant flows through the 12 Volt Pump P1 under the influence of the reduced pressure in the engine's cooling system. This avoids pulling air into the engine's cooling system and "hot spots" are avoided. The 12 Volt Pump P1 is only energized by the technician depressing the top off pump control button B1 shown on the control panel 100 (Fig. 7). Both the Used Fluid Tank T1 and New Fluid Tank T2 each have Level Indicators 122 that provide a visual indication of the liquid level in a tank. The technician by observing the liquid levels in each of these tanks can determine how much coolant has been removed from the engine's cooling system, and how much new coolant has been added. If all the used coolant has not been replaced with new coolant by simply sucking new coolant into the engine's cooling system under the influence of the reduced pressure within the engine's cooling system, the top off pump control button B1 is actuated to energized the 12 Volt Pump P1 to add more new coolant to the cooling system until all the withdrawn used coolant has been replaced. When the engine cooling system is filled with new coolant, the Supply Hose H2 is disconnected by detaching the coupling components 24c and 24b and removing the plug 26 and replacing the radiator cap 28a.

As depicted in Fig. 3, when using the system B, the engine 12 is maintained turned on so that it is operational and the knob 20a of the main switch 20 on the control panel 100 (Fig. 7) is turned manually to the "Flush Service" position to actuate the 12 Volt Pump. System B is

based on a displacement principal wherein the new coolant pushes the used coolant from the engine's cooling system. The radiator cap 28a remains in place. Prior to activating the system B, one end of the hose 27 is disconnected from the radiator 25 and adapters 10a and 10b are connected as shown in Fig. 3 to place the engine's cooling system in communication with the Used Fluid Tank T1 and New Fluid Tank T2 for transfer of used coolant from the engine cooling system to the Used Fluid Tank T1 and new coolant from the New Fluid Tank T2 to the engine cooling system. Although hose 27 is shown as disconnected, the hose 28 could be disconnected instead of hose 27, and the Supply Hose H2 could be connected to the engine 12 and the Drain Hose H1 connected to the radiator 25. New coolant displaces used coolant, flowing from the New Fluid Tank T2 into the radiator 25 through the Supply Hose H2 via the 30 Micron Filter F1, the 12 Volt Pump P1, the Check Valve C1, the Flow Indicator F2, the adapter 10a, and a replacement conduit 80 placing the radiator 25 in communication with the adapter 10a. Used coolant flows from the engine 12 into the Used Fluid Tank T1 through the Drain Hose H1 via the open Valves #1 and #2.

As illustrated in Fig. 4, system B may be operated in a loop mode whereby the used coolant circulates via a connector tube 50 between the Drain Hose H1 and Supply Hose H2. In this loop mode, coolant is continually recycled between the engine 12 and the radiator 25 via the hose 27, the adapter 10b, the Drain Hose H1, the Valve #1, the connector tube 50, the Flow Indicator F2, the Supply Hose H2, the adapter 10a, and the replacement conduit 80. There is a sensor 60 (Figs. 1, 3, and 12) located near the top of the Used Fluid Tank T1 and a sensor 62 (Figs. 1, 3, and 12) near the bottom of the New Fluid Tank T2, which, respectively, detect when the Used Fluid Tank T1 is almost

full and when the New Fluid Tank T2 is almost empty. The sensors 60 and 62 are float switches. When either of these conditions is detected by either one of these sensors 60 or 62, the system B is switch to the loop mode. The system B is also switch to the loop mode when the service is completed by displacing the maximum amount of used coolant in the engine's cooling system. When system B is in the loop mode, a buzzer 124 (Figs. 10 and 12) is activated to provide an audio alarm and the service complete light L1 on the control panel 100 is illuminated.

As depicted in Fig. 5, the coolant transfer machine 10 may be operated in a Drain Used Fluid Mode. In this mode, the Drain Hose H1 and Supply Hose H2 are disconnected from the engine 12 and the Supply Hose H2 is connected by the coupling component 24c to a coupling component 24d on one end of a conduit 52 having another end connected to a Waste Fluid Container. Upon actuating the Toggle Switch, the pressurized air is supplied to the Air Pump, activating this pump. This causes used coolant in the Used Fluid Tank T1 to flow via the conduit 56 through the Valve #3, conduit 57, the Air Pump, conduit 58, the Valve #2, conduit 59 to the inlet of the Flow Indicator and out the outlet of the Flow Indicator through the Supply Hose H2 and conduit 52 into the Waste Fluid Container.

The advantage of employing both systems A and B in the hybrid coolant transfer machine 10 is that the technician using the machine 10 will then have the ability to select the system (A or B) best suited to service a particular vehicle. With the system A, the technician does not have to disconnect hose 27 (or the hose 28), but simply replaces the radiator cap 28a. This saves time. But with some vehicles, it may be more advantageous to use system B, because a greater displacement of used coolant is achieved than would be possible using system A.